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Applicants:	Peter Mahr
Serial No.:	09/613,997
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For:	DISC SPEED CONTROL DEVICE
Art Unit:	2753

LETTER

Hon. Assistant Commissioner for Patents
Washington, D.C. 20231

Dear Sir:

Applicant hereby encloses the text of the EPO priority document Number 99401755.6, filed July 13, 1999, and requests that the subject priority document be made of record in the present application.

Respectfully Submitted,
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Date: 12/15/00

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Bescheinigung | Certificate | Attestation

Die angehefteten Unterlagen stimmen mit der ursprünglich eingereichten Fassung der auf dem nächsten Blatt bezeichneten europäischen Patentanmeldung überein.

The attached documents are exact copies of the European patent application described on the following page, as originally filed.

Les documents fixés à cette attestation sont conformes à la version initialement déposée de la demande de brevet européen spécifiée à la page suivante.

Patentanmeldung Nr. | Patent application No. | Demande de brevet n°

99401755.6

Der Präsident des Europäischen Patentamts;
Im Auftrag

For the President of the European Patent Office

Le Président de l'Office européen des brevets
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Blatt 2 der Bescheinigung
Sheet 2 of the certificate
Page 2 de l'attestation

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Anmelder:
Applicant(s):
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Titre de l'invention:
Disc speed control device

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DISC SPEED CONTROL DEVICE

The invention relates to a playing and/or recording device for a disc shaped information carrier, and more precisely to a disc speed control device.

A playing and/or recording device for a disc shaped carrier is known to adjust the disc rotation speed depending on the nature of the disc. Typically two modes are used, namely Constant Angular Velocity and Constant Linear Velocity mode.

In CAV mode the disc is rotated at a constant rotation speed. This is for example the case for Compact Disc-ROM devices which are of widespread use as computer peripherals. In a start phase after the disc has been inserted in the CD-ROM player and is ready to be read, a leading value output means generates a determined start rotation speed value. This value is output to speed servo means which regulate disc actuating means such to rotate the disc at the start rotation speed. An instantaneous disc rotation speed may be obtained from a frequency signal which is generated by frequency generating means. The frequency generating means may for example be realized by a device which is directly measuring the rotations of a motor shaft in the disc actuating means. The speed servo means receive the frequency signal, compare the determined start rotation speed with the instantaneous disc rotation speed calculated from the frequency signal, and consequently regulate the disc actuating means such that the disc keeps rotating at the determined start rotation speed. Any other speed may now be adjusted by using the leading value output means.

Disc players and/or recording devices typically comprise a pick up which may be moved relative to the rotating disc in order to be positioned for

reading and/or recording data at a determined location of the disc. In optical disc player for example the pick up comprises optical means which receive light reflected by the disc and project it on light detecting means. This way an output of the light detecting means is indicative of data scanned by the reflected light. The data may for example be recorded along tracks. The tracks form circles or a spiral having a center substantially located at a center of the disc rotation.

In CLV mode the disc is rotated such that data being read and/or recorded using the pick-up appears to be passing by the pick-up at a constant speed. This means that the disc rotation speed is actually higher when the pick-up accesses data near the center of the disc than when it accessed data near a periphery of the disc. This is for example the case in audio Compact Disc players. The disc rotation speed must be adjusted depending on where on the disc the pick-up is to access data. Typically an output of the pick-up, i.e., an output of the light detecting means is processed using signal processing means and a data frequency signal showing at which frequency data is read by the pick-up is obtained. The data frequency signal is compared to a desired frequency corresponding to a determined linear velocity and a speed servo circuit regulates the disc actuating means in a known manner such that the disk rotations speed remains adapted to have a data frequency signal substantially equal to the desired frequency.

Many players and/or recording devices for disc shaped carriers have the possibility to function in either the CAV or CLV mode. In order to realize this compatibility to CAV and CLV it is known to either have two distinct circuits for CAV and CLV or to modify the speed servo circuit of either one such that it may perform in both modes. The latter solution requires a relative high degree of complexity in the modified speed circuit. The former solution requires that in addition to the two distinct circuits, a possibility to switch between both circuits when appropriate be included.

It is an object of the present invention to eliminate the need for two distinct circuits which perform CAV or CLV.

It is another object of the present invention to lower the complexity of a speed servo circuit in a device performing CAV and CLV.

A disc speed control device according to the invention is for use in a player and/or recorder of a disc shaped information carrier to be recorded or recorded with data along data tracks, the data being read and/or recorded using a pick-up, and comprises

- Frequency generating means for generating a frequency signal having a frequency representative of a rotation speed of the disc,
- Disc actuating means for rotating the disc,
- Leading value output means for generating a determined rotation speed value,
- Speed servo means which receive the frequency signal and the determined rotation speed value, and which regulate the disc actuating means to the determined rotation speed value,
- Signal processing means which process an output of the pick-up when the data is being read and deliver a data frequency signal, and
- Speed processing means which receive and use the data frequency signal to compute the determined rotation speed value.

The invention will in the following be explained using examples and Figures, wherein

- Fig.1 contains a schematic speed regulating circuit according to the prior art,

- Fig 2. contains a schematic speed regulating circuit according to the invention,
- Fig 3. illustrates a preferred embodiment of the invention.

Fig.1 shows a schematic representation of known disc actuating means 1 which are used to rotate a disc shaped data carrier (not shown). A frequency generating means 2 measures for example the rotations of a motor shaft (not shown) which rotates in the disc actuating means 1. The frequency generating means 2 thereby generate a frequency signal which has a frequency representative of a rotation speed of the disc, and transmit this to speed servo means 3. A leading value output means 4 generates a determined rotation speed value which is transmitted to the speed servo means 3. The determined rotation speed value corresponds to a desired rotation speed in CAV mode.

The speed servo means 3 comprises a comparator means 5 which receives both the frequency signal and the determined rotation speed value, compares both inputs and delivers the result of the comparison to a regulating means 6. The regulating means 6 outputs a regulating signal to the disc actuating means 1 through an amplifier 7 such that a rotation of the disc shaped data carrier at the determined rotation speed value is obtained. This means that the disc actuating means will accelerate or decelerate the disc rotation depending on respectively if the frequency signal indicates an instantaneous speed smaller or greater than the determined rotation speed value.

Hence a CAV mode operation is achieved because the disc rotating is regulated at a constant determined rotation speed.

In Fig. 2, the determined rotation speed value is provided to the speed servo means 3 by speed processing means 8. A pick-up 9 is used to read data from the rotating disk shaped carrier (not shown) and delivers to a

signal processing means 10 a signal representative of the data scanned from the disc. The signal processing means 10 allows to generate a data frequency signal which depends on the frequency at which data is scanned by the pick-up, i.e., on the linear velocity at which the disc passes by the pick-up 9. The speed processing means 8 receives the data frequency signal and computes the determined rotation speed value. In case a CLV mode is to be achieved, the determined rotation speed value will depend on the location of the disc at which the pick-up 9 reads the data. The speed servo means 3 then regulates the disc actuating means 1 to rotate the disc at the determined rotation speed value.

The described example in fact acts as a system of two loops : an inner loop comprising the speed servo means 3, the disc actuating means 1 and the frequency generating means 2, and receiving a determined rotation speed value at its input. The second loop may be called outer loop or control loop and provides the determined rotation speed value to the input of the inner loop.

The outer loop and more precisely the speed processing means 8 which is part of it, may typically provide processing of the data frequency signal for achieving CLV mode.

In a preferred embodiment, the outer loop may also provide processing for one or many of the following situations :

a) constant speed value. In this situation, the speed processing means output or constant value for the determined disc rotation speed. Such a situation occurs for example in a start phase when the disc is inserted in the player and/or recorder, or in CAV mode when the player is used as a CD-ROM drive ;

b) freeze the instantaneous speed in case of error. This situations occurs, for example, when the signal processing means 10 are not in a state to deliver a data frequency signal because data on the disc is unreadable. The speed processing means registers the absence of the data frequency signal and outputs a speed value which was stored previous to the occurrence of an error. This way, the rotation speed may be controlled until the pick-up 9 scans readable data and a data frequency signal is generated again ;

c) generate a speed profile in case of jumps or smooth acceleration. This situation may, for example, occur when data is read in CLV mode and the pick-up is moved towards the periphery of the disc in a so-called jump, i.e., when many tracks are crossed to access data. The speed processing means anticipates the final rotation velocity required to read data on the accessed track and outputs the final rotation velocity as determined disc rotation speed to the inner loop during the jump while no data is read. This allows to save time. In another example, the speed servo means 8 simply generates a smooth acceleration of the disc rotation speed by successive outputing increasing speed values to the inner loop, the result being that when the disc rotates at higher speeds, data may be read at a higher rate.

Fig. 3 shows a preferred embodiment of an outer loop. A data Phase Locked Loop 11 receives an output from the pick-up 9. The data PLL 11 comprises means for generating a voltage U depending on a frequency of the read data rate which is defined as a PLL frequency f. The data PLL 11 outputs the voltage U according to a voltage curve 12. The voltage curve 12 shows that PLL frequencies f-, f0 and f+ correspond to voltage U-, U0 and U+. The speed processing means 8 receives at its input the voltage output by the data PLL 11 and a reference voltage U_V ; the input voltages are

compared and depending on the result the speed processing means 8 output a higher or smaller determined disc rotation value, such that the PLL frequency remains substantially at the frequency f0. Hence a CLV mode may be achieved.

The disc speed control devices described here are given as examples only and a person skilled in the art may realize other embodiments of the invention while remaining in the scope of the invention.

The disc speed control device according to the invention is particularly advantageous in that it may easily be used for various kinds of recording and/or playing modes. This is especially useful in multi-standard disc drives which need to adjust many different disc speeds to read or record data.

List of references

1	Disc actuating means
2	Frequency generating means
3	Speed servo means
4	Leading value output means
5	Comparator means
7	Amplifier
8	Speed processing means
9	Pick-up
10	Signal processing means
11	Data Phase Locked Loop
12	Voltage curve.

CLAIMS

1. Disc speed control device for use in a player and/or recorder of a disc shaped information carrier to be recorded or recorded with data along data tracks, the data being read and/or recorded using a pick-up (9), the device comprising :

- Frequency generating means (2) for generating a frequency signal having a frequency representative of a rotation speed of the disc,
- Disc actuating means (1) for rotating the disc,
- Leading value output means (4) for generating a determined rotation speed value,
- Speed servo means (6) which receives the frequency signal and the determined rotation speed value and which regulates the disc actuating means to the determined rotation speed value,

Characterized in that it further comprises :

- Signal processing means (10) which process an output of the pick-up when the data is being read and deliver a data frequency signal,
- Speed processing means (8) which receives and uses the data frequency signal to compute the determined rotation speed value.

2. Disc speed control device according to claim 1, wherein the signal processing means comprises a data phase locked loop means (11) which outputs a voltage (U-, U0, U+) corresponding to a phase locked loop frequency (f-, f0, f+) of the rate at which data is read by the pick-up, and comprising a reference voltage source which delivers a reference voltage (U_V) at an input of the speed processing means.

3. Optical disc player and/or recorder characterized in that it comprises a disc speed control device according to anyone of claims 1 or 2.

ABSTRACT

A disc speed control device for use in a disc player and/or recorder having a pick-up for reading / recording data comprises an inner loop which regulates a determined disc rotation speed value received at its input and an outer loop which delivers this speed value depending on a frequency at which data is read by the pick-up.

Fig. 2.

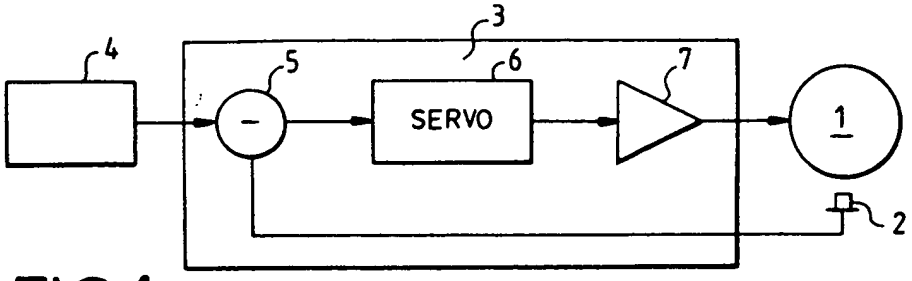

FIG. 1 PRIOR ART

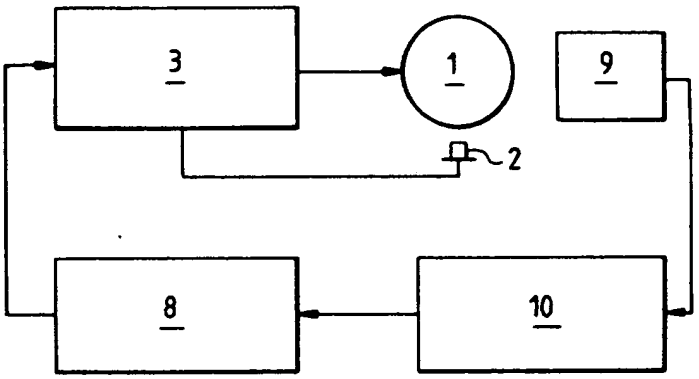

FIG. 2

FIG. 3